Hubbell Industrial Controls, Inc.

Electric Fire Pump Controllers

Specifications for *LXi* 2100 Controllers * Solid State Soft-Start/Stop With Transfer Switch * July 2002

The fire pump controller shall be factory assembled, wired, and tested as a unit assembly, shall conform to the requirements of the latest editions of NFPA-20 and NFPA-70, and shall be Listed/Approved by and bear the label of UL/FM. The controller shall be Hubbell-Lexington *LXi* 2100 equipped with *LXi* logic.

The controller shall be of the combined manual/automatic type and be furnished in a floor mounted drip-proof steel Type 2 enclosure with lifting eyes. The enclosure shall be red with a non-glare surface. The controller shall be for solid state soft start/stop and designed, tested, and marked for the rated horsepower and 3-phase voltage and frequency in a 40 degree C. ambient.

The soft-start controller shall include a full-wave three-phase controlled, open loop starting assembly consisting of control logic and a separate three-phase full-wave (anti-parallel) SCR thermistor assembly. The control logic shall be conformal coated and carry a 5 year warranty. Circuit adjustments and LED indicators shall be in the front of the control logic for accessibility and indicating.

The SCR controller shall be designed and rated to carry locked rotor current (600% of FLA) for 20 seconds as required by NFPA 20. SCR's rated for 500% for 10 seconds shall not be acceptable. The SCR's utilized in the thermistor assembly shall have a minimum 1200 volt PIV rating and Dv/Dt protection including 100 joule minimum MOV's per phase.

The solid-state starter shall supply a reduced voltage which will increase to full voltage along an acceleration ramp, adjustable between 0.5 and 10 seconds. The controller shall include a motor contactor bypass for the SCR unit when full-voltage has been reached, or in the event of overheating of the SCR unit.

For normal stopping situations the controller shall initiate a stop sequence through the solid-state unit. The starter shall decrease the voltage applied to the motor via an adjustable deceleration ramp (between 0.5 and 10 seconds) to a preset adjustable voltage level. The starter shall hold at this voltage level for an adjustable time period between 3 and 60 seconds to monitor for another starting cause. The deceleration/minimum speed hold feature of the controller shall provide reduced hydro-mechanical stress in the system piping. If no new starting cause occurs during the deceleration/minimum speed period the controller will decelerate the fire pump to a full stop. The "Soft Stop" pushbutton shall cause the controller to initiate the same stop sequence through the solid-state starter. The "Emergency Stop" push button shall cause the controller to bypass the solid-state starter deceleration and stop immediately.

The soft-start module shall be provided with the following indicating diagnostics :

Power Available	Green LED	Controller Initiate	Blue LED
Acceleration	Yellow LED	Run	Yellow LED
Deceleration	Yellow LED	Minimum Speed	Yellow LED
Emergency Stop	Blue LED	Shorted SCR	Red LED

All electrical components shall be accessible from the front for maintenance and service. No components or component wiring shall be permitted on the door of the enclosure. The controller shall have a common operating handle for both the line isolating switch and the controller circuit breaker mounted in the enclosure flange. The minimum withstand rating for the fire pump controller shall be 150,000 amps RMS symmetrical at 200-600volts. The unit shall be Listed/Approved with UL/FM as "Suitable For Use As Service Equipment".

The controller shall have separate and independent pressure settings with minimum run timing capable of a setting of 10 minutes. Settings of the pressures shall be established at the time of the field acceptance test. Provisions shall be included to allow manual or automatic shut-down in the field.

The controller shall have two sets of Form "C" contacts for Pump Running, Phase Reversal, Power/Phase Failure, and one set of Form "C" contacts for Trouble. The Trouble contacts shall be activated by the following conditions: Invalid Configuration Memory, Emergency Manual Start, Pump Running, Phase Failure, Phase Reversal, Overload, Locked Rotor, Fail-to-Start, and Lockout.

The controller shall be equipped with *LXi intelligent fire pump control system logic*. All firmware shall be non-volatile flash based CPLD (*complex-programmable logic device).* The boot-up time for the logic shall be 3 seconds or less. Controllers that do not boot-up and allow the pump to be started in 3 seconds or less are not acceptable. An RS232 serial port shall be supplied for downloading event history to a PC for analysis and printing.

The digital pressure readings and settings shall be displayed on the *LXi* LCD mounted on the enclosure flange. The LCD screen shall be 4 x 20 (4 lines of 20 characters) per screen, and the screens may be scrolled to give a total of 320 characters. The real time display shall give simultaneous 3-phase digital amps and volts for the pump power, and digital display for the system pressure. Controllers that do not simultaneously display digital 3-phase amps, line-to-line volt readings, and system pressure, are not acceptable.

The event alarm caches shall be compartmentalized, and no compartment shall over-ride any other compartment. The compartments allow for analysis of four types of information events without having to look through all events including those not related to a problem. Events shall be shown with Date and Time for each event occurrence:

1. Events that have occurred during a pump idle period
2. Events that occurred during the last start period
3. Events that occurred during the last run period
4. Events that occurred during the last stop period.

The LED displays shall be mounted on the enclosure flange and have an LED for the following, with provisions for three spare LED's to be available and programmable for other options or event displays.

Power Available	Fail to Start	Lockout On	Low Suction
Phase Reversal	Run Timer On	Pump Start Delay On	Shorted SCR
Pump Running	Locked Rotor	Overload	Overtemp SCR
Pressure Switch Start	Local Manual Start	Remote Start	Emergency Manual Start
Local Manual Stop	Start Timer/Accelerate		

The LED displays shall be mounted on the enclosure flange and have an LED for the following:

Programming of the *LXi* logic shall be from the touch pad mounted on the enclosure flange. Programming shall be password protected so that only authorized personnel can change the logic functions. The fire pump controller shall be Model *LXi* 2100 equipped with *LXi* Logic as manufactured by Hubbell Industrial Controls, Inc.

Automatic Transfer Switch

The fire pump automatic transfer switch shall be electrically operated - mechanically held on both the emergency and normal power source sides, and rated for continuous duty in an unventilated enclosure. The transfer switch shall be rated and listed for fire pump service and be UL 1008 listed and FM Approved, and shall be electronically controlled for automatic switching, and capable of manual operation.

The transfer switch logic shall monitor the emergency power source for all three phases before permitting transfer from the normal source. Transfer switches monitoring only two phases of either source are not acceptable. The fire pump automatic load transfer switch specified shall include the following features:

- Full Phase Protection – the solid state phase monitor shall be a field adjustable, close differential type, with 85-100% pickup and 75-98% dropout. A single adjustment shall set all phases.
- Solid state, three phase voltage and frequency monitor on generator output to prevent transfer prior to proper output parameters, adjustable 85-100% of generator voltage and frequency, with adjustable dropout of 75-85% setting.
- Adjustable 2 to 30 minutes on retransfer of load to normal.
- Adjustable 2 to 30 minutes cool-down timer when the generator set runs unloaded after retransfer to line.
- Motor load decay time delay, adjustable from 1.5 to 15 seconds and operating on transfer to either source.
- Adjustable 0.5 seconds to 5 minutes time delay on transfer to emergency source after verification of emergency source voltage and frequency.
- Test switch to simulate normal power failure.
- Phase loss and phase reversal monitor to initiate transfer to emergency power.
- "Normal" and "Emergency" position LED's.
- Engine start contacts for generator.
- Aux. contacts for normal and emergency positions.
- Emergency source isolating switch/motor circuit protector, as a means of disconnect. The switch shall include aux. contacts to inhibit engine starting when switch is open.
- Audible and visual alarm to indicate isolating switch is open, with "Normal-Silence" selector switch and re-ring function.
- Push button to bypass retransfer to normal time delay.

The following diagnostic LED indications shall be provided:

Normal Source Voltage O.K.	Green LED
Emergency Source Voltage O.K.	Red LED
Emergency Frequency O.K.	Green LED
Transfer to Emergency Timing	Red LED
Transfer to Normal Timing	Red LED
Engine Running Unloaded Timing	Red LED

The transfer switch shall be model LX450 as manufactured by Hubbell Industrial Controls.